

# 1\_\_sanity\_checks

August 8, 2022

## 1 Experiment Notebook: Sanity Checks

## 2 Table of Contents

- [Experiment Summary](#)
- [Experiment Assumptions](#)
- [Experiment Setup](#)
- [Analysis 1: System Dynamics Over Volatile Asset Price Trajectories](#)
- Analysis 2.1: State Variable Relationships
- Analysis 2.2: State Variable Correlation
- [Analysis 3: Liquidity Pool Dynamics](#)

## 3 Experiment Summary

The purpose of this notebook is to perform a set of sanity checks that validate the expected key system dynamics, as well as the relationships between different key state variables. These analyses should also serve as an educational explanatory tool for less intuitive system dynamics and as an introduction to the model.

## 4 Experiment Assumptions

See [assumptions document](#) for further details.

## 5 Experiment Setup

We begin with several experiment-notebook-level preparatory setup operations:

- Import relevant dependencies
- Import relevant experiment templates
- Create copies of experiments
- Configure and customize experiments

Analysis-specific setup operations are handled in their respective notebook sections.

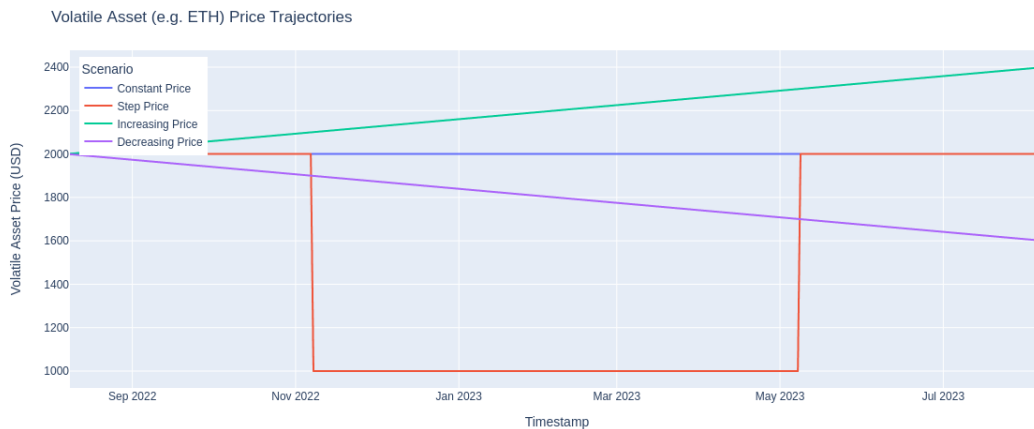
## 6 Analysis 1: System Dynamics Over Volatile Asset Price Trajectories

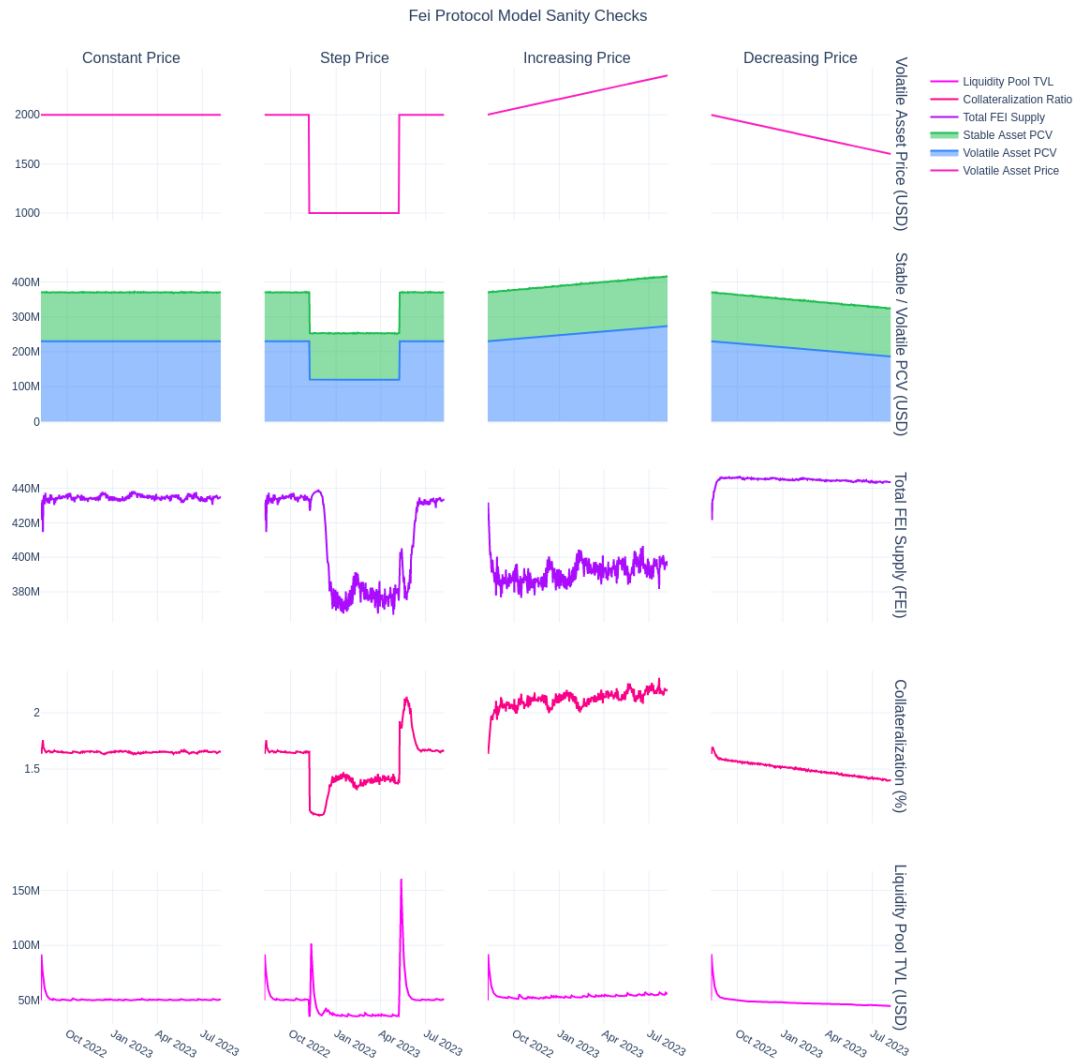
The Fei Protocol Model is strongly driven by the Volatile Asset price process - mimicking the dependency on the Ethereum price which avenues of FEI and PCV have in the system.

In this analysis we look at the effect of setting the Volatile Asset price trajectory in four scenarios: - As a linear constant price - As a step price - As a linearly increasing price - As a linearly decreasing price

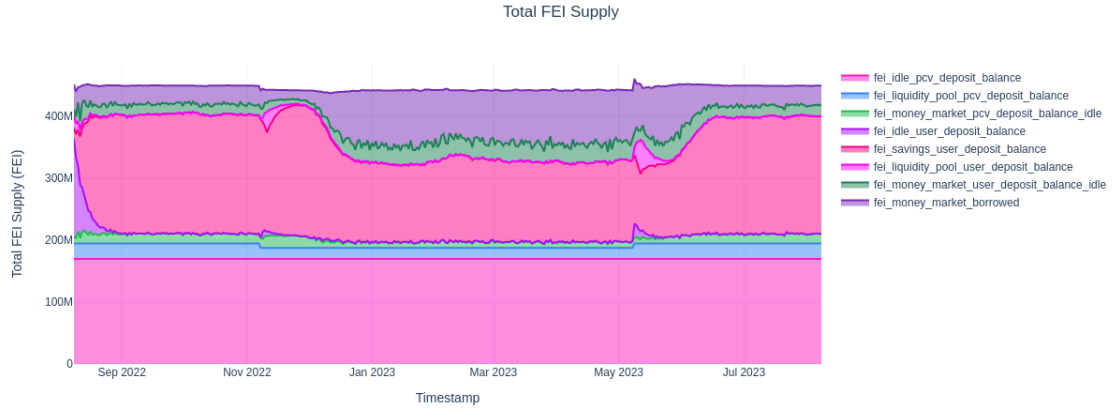
The purpose of this analysis is to illustrate and validate the driving influence of the Volatile Asset price on key system dynamics.

```
2022-08-08 16:06:56,727 - root - INFO - Running experiment
2022-08-08 16:06:56,840 - root - INFO - Setting up initial state
2022-08-08 16:06:56,846 - root - INFO - Setting up initial state
2022-08-08 16:06:56,851 - root - INFO - Setting up initial state
2022-08-08 16:06:56,856 - root - INFO - Setting up initial state
2022-08-08 16:06:56,902 - root - INFO - Starting simulation 0 / run 0 / subset 0
2022-08-08 16:06:56,929 - root - INFO - Starting simulation 0 / run 0 / subset 1
2022-08-08 16:06:56,979 - root - INFO - Starting simulation 0 / run 0 / subset 3
2022-08-08 16:06:56,955 - root - INFO - Starting simulation 0 / run 0 / subset 2
2022-08-08 16:07:01,459 - root - INFO - Experiment complete in 4.725552558898926
seconds
2022-08-08 16:07:01,461 - root - INFO - Post-processing results
2022-08-08 16:07:04,741 - root - INFO - Post-processing complete in
3.2815394401550293 seconds
```



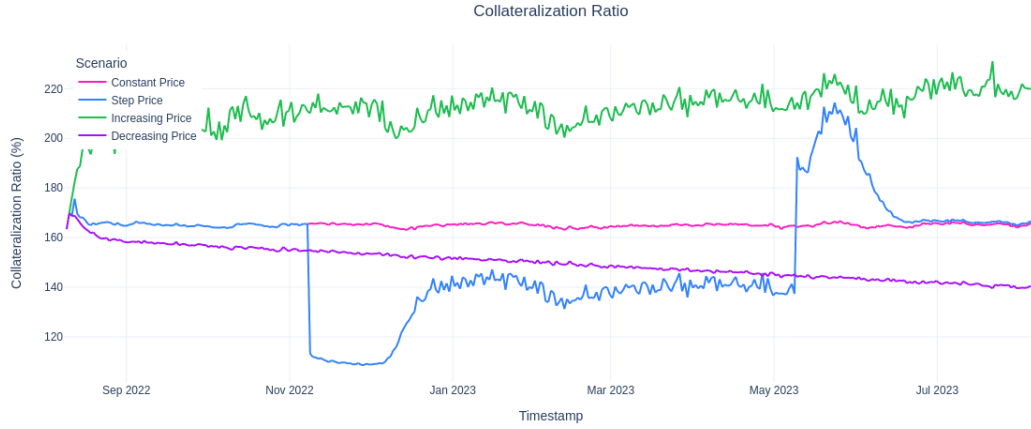


By looking at the components of total FEI supply in the subset with a step decrease in the volatile asset price, we can further develop our intuition about the behaviour of the model:



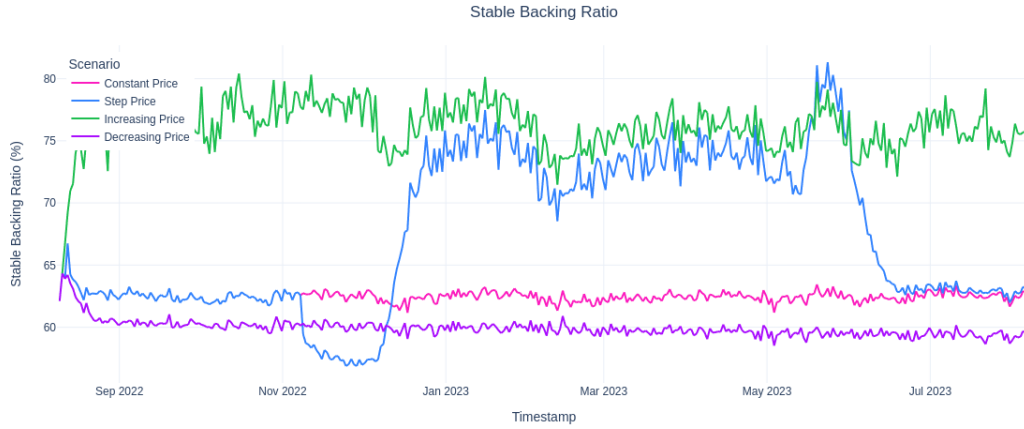
## 6.1 Effect of Volatile Asset Price Trajectory on Main KPIs

### 6.1.1 1. Collateralization Ratio



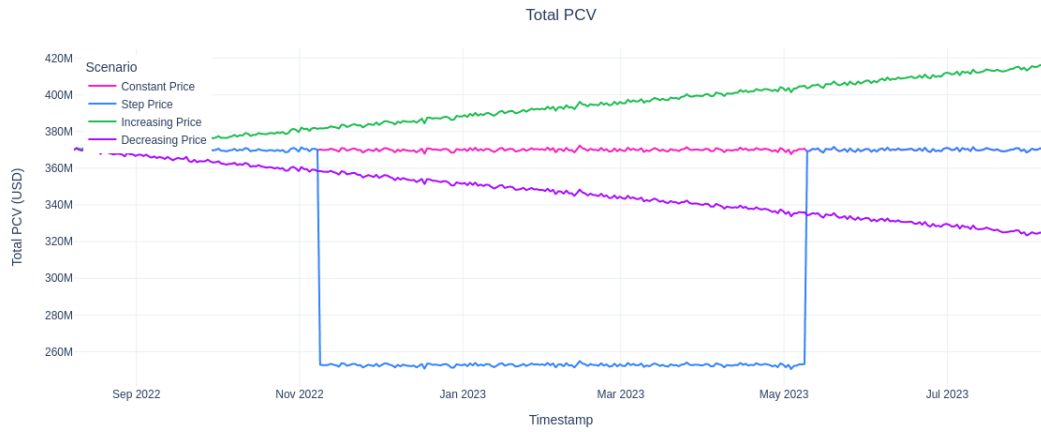
	volatility	max	min	final value	max dd
0	0.004520	1.756995	1.630649	1.648695	-0.059757
1	0.031696	2.144579	1.086488	1.657691	-0.344108
2	0.021348	2.310990	1.635099	2.210180	-0.091632
3	0.004699	1.696978	1.393542	1.393542	-0.069264

## 6.1.2 2. Stable Backing Ratio



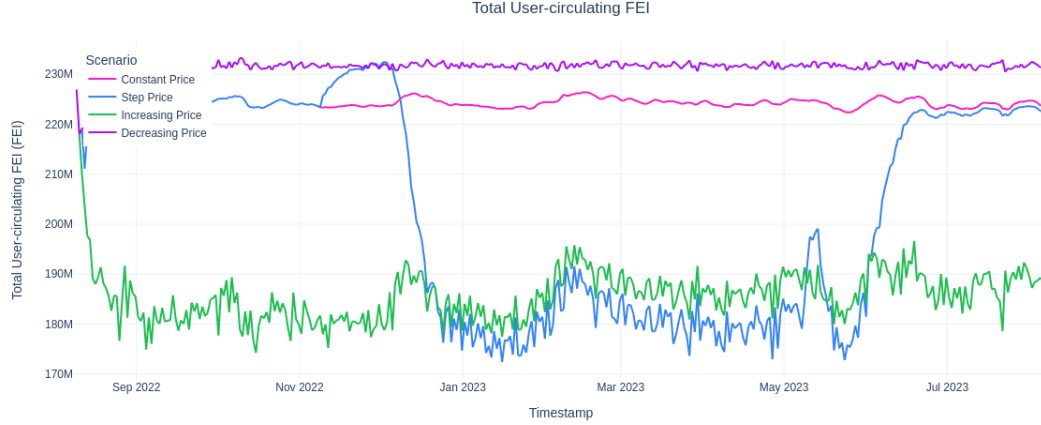
	volatility	max	min	final value	max dd
0	0.007794	0.667451	0.611586	0.621448	-0.063880
1	0.017963	0.813278	0.568741	0.625013	-0.230444
2	0.022316	0.806763	0.621104	0.754334	-0.108294
3	0.007770	0.643210	0.585159	0.588886	-0.064549

## 6.1.3 3. Total PCV



	volatility	max	min	final value	max dd
0	0.002584	3.723333e+08	3.676935e+08	3.691417e+08	-0.009568
1	0.029354	3.716663e+08	2.505774e+08	3.692395e+08	-0.323055
2	0.002453	4.161610e+08	3.700000e+08	4.148644e+08	-0.007106
3	0.002742	3.708225e+08	3.229628e+08	3.229628e+08	-0.020128

#### 6.1.4 4. Total User-circulating FEI

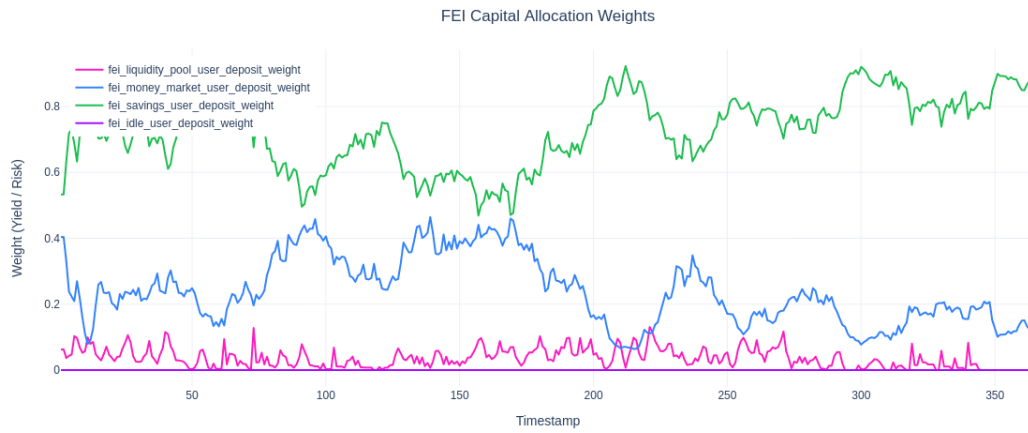
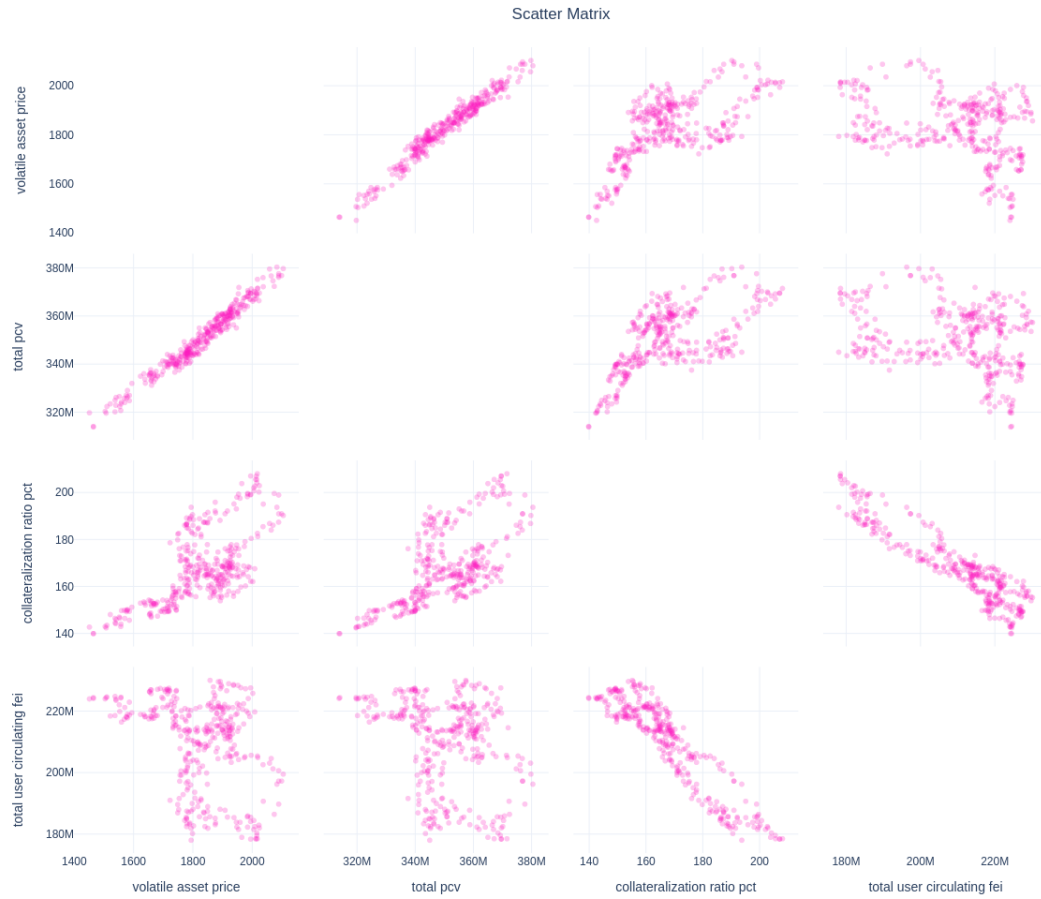


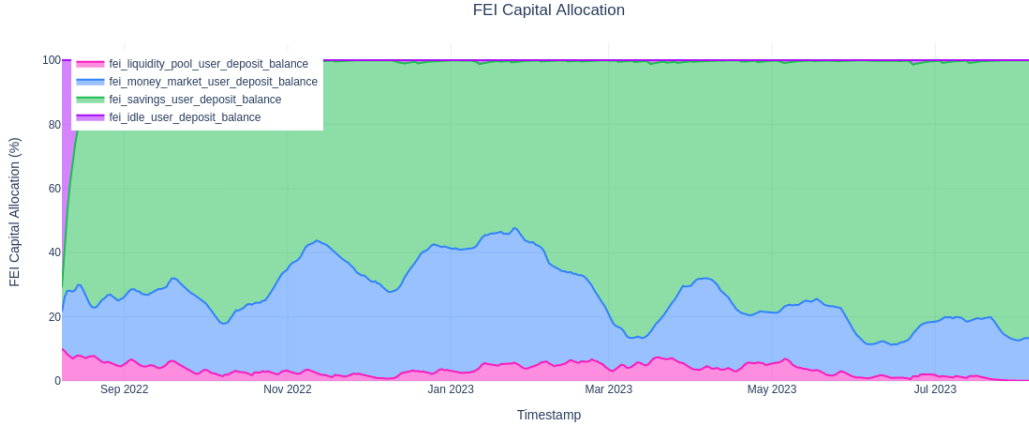
	volatility	max	min	final value	max dd
0	0.003627	2.268706e+08	2.110974e+08	2.238994e+08	-0.017312
1	0.016959	2.324895e+08	1.723971e+08	2.227433e+08	-0.248589
2	0.021226	2.269433e+08	1.742415e+08	1.877061e+08	-0.191045
3	0.003832	2.332320e+08	2.180382e+08	2.317568e+08	-0.010535

## 7 Analysis 2.1: State Variable Relationships

The purpose of this analysis is to illustrate and validate the relationships between and distribution of key system state variables using the model's default experiment initial state and system parameters.

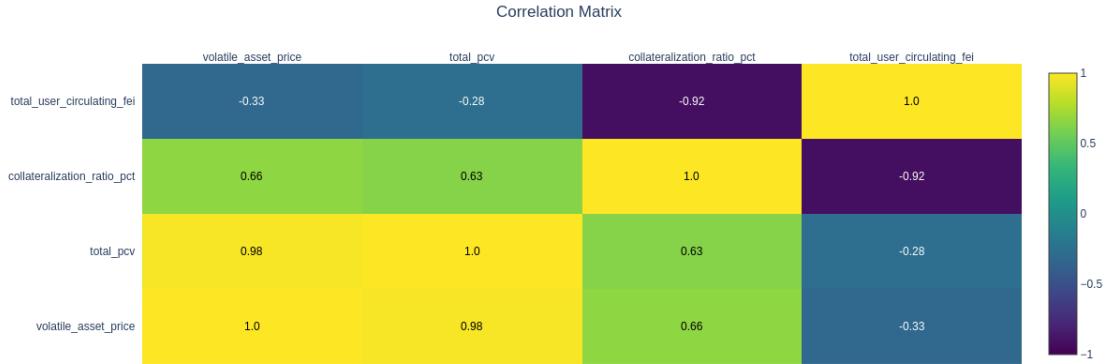
```
2022-08-08 16:07:17,886 - root - INFO - Running experiment
2022-08-08 16:07:17,970 - root - INFO - Setting up initial state
2022-08-08 16:07:18,016 - root - INFO - Starting simulation 0 / run 0 / subset 0
2022-08-08 16:07:21,817 - root - INFO - Experiment complete in 3.929943084716797
seconds
2022-08-08 16:07:21,818 - root - INFO - Post-processing results
2022-08-08 16:07:22,688 - root - INFO - Post-processing complete in
0.870917558670044 seconds
```





## 8 Analysis 2.2: State Variable Correlation

The purpose of this analysis is to illustrate and validate the correlation between key system state variables.



## 9 Analysis 3: Liquidity Pool Dynamics

The purpose of this analysis is to illustrate and validate the effect of a step change in the Volatile Asset price on the liquidity pool imbalance, resulting minting and redemption, and capital allocation.

Evaluating the second subset, a step in the volatile asset price, we expect the following results:

1. A step in the volatile asset price results in an imbalance in the liquidity pool, which is rebalanced by:



- Step down in volatile asset price results in an excess of FEI in the pool: FEI is released from the liquidity pool into the circulating supply and **redeemed**
  - Step up in volatile asset price results in a deficit of FEI in the pool: FEI is **minted** and deposited into the liquidity pool
2. The rebalancing transaction volume causes a spike in transaction fees collected and resulting liquidity pool yield rate
  3. The capital allocation weights for the liquidity pool increase
  4. The capital allocation Model moves user FEI into the liquidity pool

